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TITLE: LOW ENERGY PI SUPER PLUS _p ELASTIC SCATTERING

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LOW ENERGY π^+p AND π^-p ELASTIC SCATTERING*

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We have measured the differential cross sections for both π^+p and π^-p elastic scattering at pion kinetic energies of 29.1, 49.3, 69.4, and 89.4 MeV. The data was obtained on the Low Energy Pion channel at the Clinton P. Anderson Meson Physics Facility (LAMPF). The beam of pions was incident upon a 1.4 cm-thick liquid H₂ target which was rotated at 45° with respect to the beam line. The amount of H₂ which was in the beam line was determined by optical measurements of the target thickness and by thermometry and pressure measurements of the surrounding H₂ gas volume. This thickness was checked by differential range techniques. The beam flux of 10^4 to 10^5 π /sec was monitored by ion chambers, by scaling a beam counter and by counter telescopes which were sensitive to $\pi \rightarrow \mu\nu$ decay.

Coordinates of the scattered particles were observed with a series of four multiwire proportional chambers. The reconstructed

trajectories were extrapolated back to the beam line and cuts were made to demand that the scattered particles came from the liquid H₂ region. The pions were identified from other backgrounds from both energy loss and range information within stacks of scintillation counters. Residual backgrounds which were typically < 10% of the πp signal were subtracted by taking data with the liquid H₂ replaced by H₂ gas. Approximately 40,000 πp elastic events were obtained for each energy-polarity combination between the laboratory scattering angles of 45° to 145°.

Figure 1 shows preliminary π^+p and π^-p elastic scattering cross sections for $T_\pi = 49.3$ MeV. We are working on the absolute normalization of the data; the uncertainty is presently $\sim 15\%$.

Results for the four energies for both π^+p and π^-p elastic scattering will be presented.

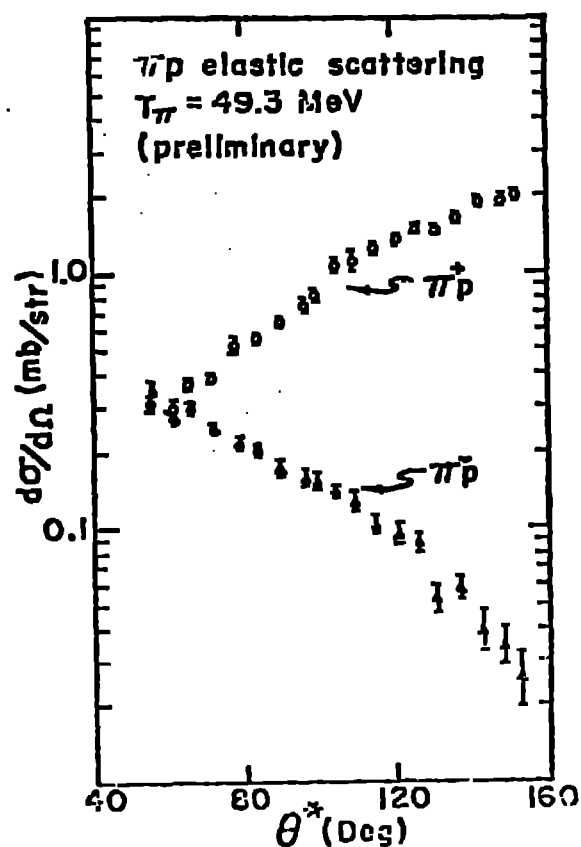


Fig. 1. πp elastic differential cross sections in the center of mass system.

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Figure 1a - d show preliminary π^-p elastic scattering cross sections for $T_\pi = 29.1, 49.3, 69.4,$ and 89.4 MeV. The normalization of the data, which is presently uncertain to $\sim 15\%$, has been floated to agree with an energy dependent phase shift fit of all low energy pion-nucleon measurements below 300 MeV.¹ The relative cross sections have been allowed to effect the energy dependent fit to low energy pion-nucleon data. The error bars shown are due only to the statistics of the πp elastic signal level folded in with the Monte Carlo statistics. Data obtained with differing beam conditions and detector rotations which were taken to check any possible systematics have not yet been combined.

At the current level of analysis, the angular distributions for π^+p are of similar quality to the measurements of Bertin et al.² The π^-p measurements tie in well to Bussy et al.³ 88.5 MeV differential cross sections and are of much higher precision than other published π^-p angular distributions below 100 MeV.

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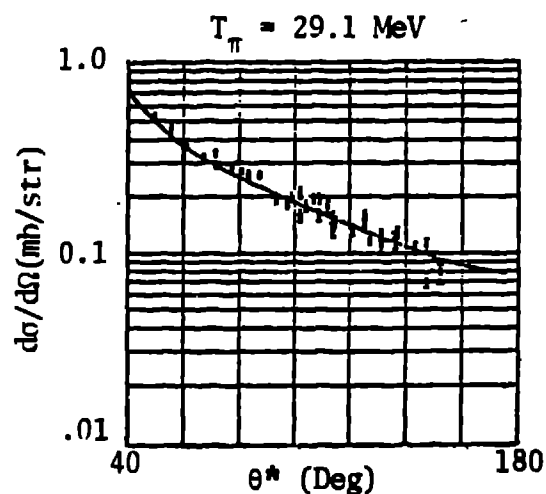


Fig. 1a

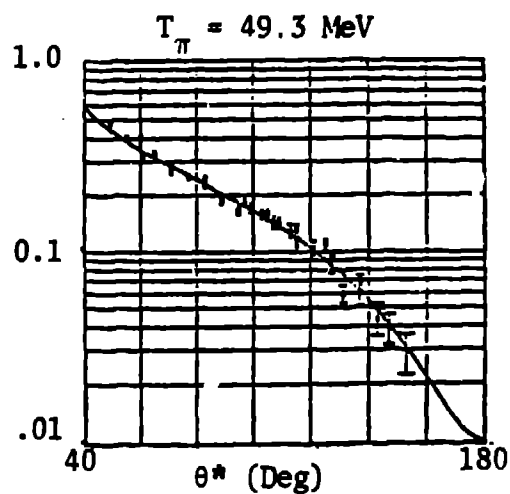


Fig. 1b

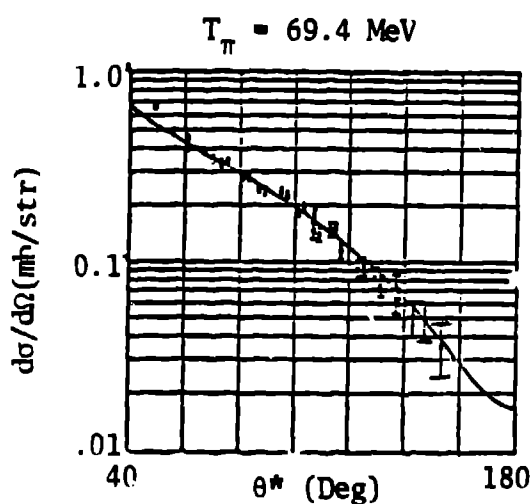


Fig. 1c

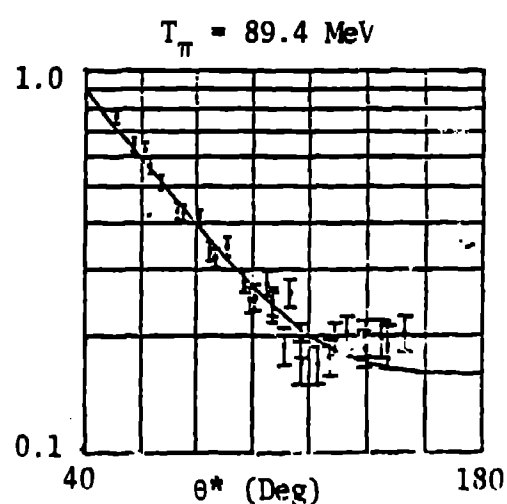


Fig. 1d

Fig. 1. π^-p elastic differential cross sections in the center of mass system at $T_\pi =$ a) 29.1 MeV, b) 49.3 MeV, c) 69.4 MeV, and d) 89.4 MeV (preliminary).

¹ D. Dodder, private communication.

² P. Y. Bertin, B. Coupat, A. Hivernat, D. B. Isabelle, J. Duclos, A. Gerard, J. Miller, J. Morgenstern, J. Picard, P. Vernin, and R. Powers, Nucl. Phys. **B106**, 341 (1976).

³ P. J. Bussey, J. R. Carter, D. R. Dance, D. V. Bugg, A. A. Carter, and A. M. Smith, Nucl. Phys. **B58**, 363 (1973).